tirely original, as, for example, Tobit ben Korra for Thabit ben Qorra.

The most amusing statement is, "Fahri des al Karhi, who flourished about the beginning of the eleventh century, is the author of the most important Arabian work on algebra." Now Al-Fakhri, or Fakhri, is, indeed, the title of an Arabic work on algebra by one Abu Bekr Mohammed ibn Al-husain Al-Karkhi, or Al-Karkhi, for short. But the *des* seems, at first, unexplainable. The probability is that the *des* is German and some chance reference in German to the Fakhri des Al-Karkhi, the Fakhri of Al-Karkhi, undoubtedly accounts for this Farhi des Al Karhi.

Equally bad from a mathematical point of view is the surprising statement that "the Arabs accomplished the general solution of numerical equations."

The shorter article by the same writer on "Geometry, History," contains, of course, fewer errors. We must regard it as fortunate, in view of the errors I have shown and others not noted in the article on the history of algebra, that there is no article on the history of arithmetic. In pleasing contrast to these articles mentioned is the summary of the history of trigonometry by E. W. Hobson.

The one man best qualified to write a summary of the history of algebra and also of geometry is undoubtedly Sir Thomas L. Heath, sometime fellow of Trinity College, Cambridge. Even in 1910 the Cambridge University Press published a second edition of Heath's "Diophantus" and in 1908, Heath's "The Thirteen Books of Euclid's Elements," in three volumes. We may well express our surprise that the fame of Sir Thomas Heath should not be known to his Alma Mater, which stands sponsor for the encyclopedia, and that his aid was not sought for the history of mathematics in the Britannica.

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DEVASTATION OF FORESTS IN THE WHITE MOUNTAINS

To those who have supposed that the Weeks bill for the preservation of the Appalachian forests has settled a long-debated question, and that the advocates of the measure may now take a rest, secure in the belief that its execution is in the hands of a scientific man, armed both with authority and with knowledge, the article by Winthrop Packard in the *Boston Transcript* for October 7, 1911, stating the results of his exploration of the White Mountain region during the past summer will be a distinct shock.

"Lumbering," says Mr. Packard, "used to be a winter job, but there is no let-up in the rush now on to get the last spruce off the high levels of the White Mountains." The Weeks bill "is still about to work. But meanwhile the only part of it which is really working is the joker . . . which makes it indefinitely inoperative." An "innocent little paragraph in the Weeks bill says, in effect, that the head of the United States Geological Survey shall decide what areas are to be reserved along the head waters of the navigable rivers."

"Meanwhile, whether it affects the navigation of the Connecticut, the Androscoggin, the Saco and the Merrimac or not, the last of the good black growth of spruce, fir and hemlock is rapidly coming off the higher slopes of the Presidential Range and the lesser ranges that surround it."

"The best of the beautiful primeval forest is still above the high-water mark of this cutting, but it will take only a winter or two to encompass its downfall, and the investigations of the Geological Survey may probably be depended upon to hold the Weeks bill by the throat for that length of time, if not forever.

"The largest body of spruce left within sight of Mount Washington is that which lies at the head of the Rocky Branch Valley, between the Montalban Range on the west, the Rocky Branch Ridge on the east and Boott's Spur. . . . Here are some square miles of splendid black growth. . . . It is a virgin forest which one might suppose would last because of its inaccessibility. It is walled in by mountains on three sides and is sixteen miles up a tremendously rough valley from the south. This valley is drained by a tributary

of the Saco, a stream so capricious and boulder-strewn that it would be an impossibility to drive logs down it. But spruce and hemlock are exceedingly valuable nowadays, and, morever, that Weeks bill threatens—or would threaten if it were not for that little joker—to prevent the slaughter of trees so near Mount Washington. So a lumber railroad has been driven with great energy up to the very center of this last refuge of the forest primeval."

In the Crawford Notch the cutting has been carried as far up as the Frankenstein Trestle. "The whole easterly slope of the Franconia Range and the valleys among the foothills of this range have been denuded. Indeed, from the summit of Lafayette almost all that the eye can see of the lower and western part of the Pemigewasset Valley has been swept clean and left a leafless, brown desert of slash. So from Carrigan Summit it shows on the southerly slopes of Bemis, Anderson, Lowell and Nancy."

It is evident from the above that the cutting of the forest is progressing at an unprecedented rate, and this, not merely on the lower and more gentle slopes where there is a possibility that the growth of spruce may be renewed, but also on the upper and steeper inclines where the forest, when once removed, is gone, if not forever, still at least until the next Ice Age wipes out the relics of human folly, renews the mantle of drift, and restores, after the recession of the ice, those climatic conditions which make the initiation of evergreen forests possible in such situations.

At the conference of governors, called by President Roosevelt to consider the conservation of our natural resources, after reciting the axiom: "The great natural resources supply the material basis upon which our civilization must continue to depend and upon which the perpetuity of the nation itself rests," the conference made the following unanimous declaration:

"We agree, in the light of the facts brought to our knowledge and from information received from sources which we can not doubt, that this material basis is threatened with exhaustion. Even as each succeeding generation from the birth of the nation has performed its part in promoting the progress and development of the republic, so do we in this generation recognize it as a high duty to perform our part; and this duty in large degree lies in the adoption of measures for the conservation of the natural wealth of the country." It was further declared that "this conservation of our natural resources is a subject of transcendent importance, which should engage unremittingly the attention of the nation, the states and the people in earnest cooperation."

All of this is matter for consideration in the light of science. As abstract questions, these declarations received universal acquiescence; but diversity of opinion arises in their application, and here we enter upon a sphere of action where science and politics must combine. Distasteful as it may be to men of science to enter into the sphere of politics, the lesson which the laborers have been slowly learning, that the needs of industry receive no attention until pushed to the center of the political arena, must apparently be taken home by science also.

One of the declarations of the governors reads: "That sources of national wealth exist for the benefit of the people, and that monopoly thereof should not be tolerated." Here this honorable body touches the crux of the whole matter.

As soon as remedial legislation is attempted, the forces of monopoly show themselves to be stronger than science, stronger than governors or presidents. In fact, there is only one power that is greater—that of the people. Whenever the nation becomes so thoroughly aroused that its people act together as one man, monopoly will be overthrown. Until that time arrives, there is need for science to continue a campaign of education and to continue it *unremittingly* as the governors advise.

After the first flush of enthusiasm has cooled, look for reaction and apparent back track to make way for the next wave of advance. The need of a new movement is

already immanent. Though the campaign of education may flag, the exploiters of the nation's resources, who act without regard to ultimate consequences and for self-interest only, anxious lest their special privileges may be curtailed, are not letting the grass grow under their feet.

It becomes necessary for men of science to reiterate the fundamental facts, which they can do in the present instance with the certainty that scientific prognostications anent the passing of the forest and its resulting woes can not be made too loud or too often. The American Association for the Advancement of Science, whose memorial in 1873 was one of the beginnings of the present conservation movement, could not do a better thing than to present at its coming session another memorial to Congress, recounting the lessons which the engineers have been learning.

Professor Willis L. Moore, in his report as Chief of the Weather Bureau for 1909–10 (p. 18) says: "After an elaborate research into all available data, the Weather Bureau, in company with many eminent engineers, concludes that on the principal rivers the floods are not higher or longer continued or the low water lower than forty years ago, while other persons hold to the opposite." Nothing whatever is said as to changes in forestation of the river-basins investigated during the forty years, a point on which Professor Swain has commented in his review[1] of another work by the same author. In the more thickly settled parts of the country, deforestation was already far advanced forty years ago. Attention to earlier records shows a very different condition.

Mr. Joseph B. Walker, writing in 1872, said that "the rapid destruction of the forests" of New Hampshire was then "painfully apparent everywhere"; and in 1891 the same author said: "The volumes of our streams are less equable than formerly. In summer they are greatly reduced. Many brooks whose flow was once perennial are no longer to be found for one half of the year. This fact is due to the total or partial denudation of the land from which they flow. So serious an evil had this become, some thirty or forty years ago, that the manufacturing companies upon the lower part of the Merrimac were forced to construct vast storage reservoirs, at great expense, which can be drawn upon as water is wanted. Winnepesaukee Lake and Long Pond are two of these. Total denudation at the source of our streams would convert them into destructive torrents in spring and their channels into dry ditches for the rest of the year." The last is of course an inference, but one that is not improbable.

Similar occurrences have taken place in central New York. "With the clearing away of the forests and the burning of the forest floor came a failure of canal supply that necessitated the building of costly dams and reservoirs to replace the natural ones which the fire and axe had destroyed. The Mohawk River, which for years had fed the Erie Canal at Rome, failed to yield any longer a sufficient supply, whereupon the Black River was tapped at Forestport, and its whole volume at that point diverted southward to assist the Mohawk in its work." The reports of the superintendent of public works in New York State, thirty or more years back, reiterate the progressive failure of the water supply and appeal for the protection of the forests. We hear less of these complaints to-day simply because the railroads are in full control and many of the early canals are abandoned. But the time will surely come when this policy will be recognized as a mistake.

B. E. Fernow, in a paper on the "Relation of Forests to Water Supplies," writing in 1892,[2] cites the earlier changes in the Schuylkill River: "During the last sixty or sixty-five years," he says, "this river has shown a marked diminution in its *minimum* flow. In

[1] "The Influence of Forests on Climate and on Floods," a review of Professor Willis L. Moore's report, by George F. Swain, LL.D., professor of civil engineering, Harvard University, *American Forestry*, Vol. 16, pp. 224–240, April, 1910.

[2] Bulletin No. 7, Forestry Division, U. S. Department of Agriculture, 1893, p. 165.

1816 this flow was estimated at 500,000,000 gallons per day; in 1825 at 440,000,000; in 1867 at 400,000,000, and in 1874 at 245,000,000. In regard to this a commission of engineers say in their report in 1875: This remarkable decrease, not being accompanied by any great change in the rainfall, is no doubt largely due to the destruction of the forests in the drainage area, whereby the conservative action of the woodland has been lost, and the rainfall is permitted to descend rapidly to the bed and pass off in a succession of freshets."

The same bulletin (pp. 23–122) contains an elaborate "Review of Forest Meteorological Observations," by Professor Mark W. Harrington, who treats the data obtained at a considerable number of German stations by an original system of curves, bringing out the fact that the forest is cooler than the neighboring open country by several degrees. Being cooler, the dew-point is reached more quickly in the forest, when atmospheric conditions favor rain. The forest has (1) larger evaporation from widespread leafy surfaces and moist shaded soil, (2) cooler atmosphere from the local evaporation and (3) greater precipitation. Effects (1) and (3) so nearly compensate that there is hardly any difference in the total run-off from a given area, whether forested or not, but a great difference in the distribution of the flow in its annual fluctuation.

The forest question is not a meteorological problem, but one of soils, erosion and drainage. In France enormous sums of money are being expended in a toilsome effort to undo the mistakes of the past and to reforest the steep slopes. It seems strange that "eminent engineers" should not be aware of these facts, and that our country must repeat all of these unhappy blunders of older nations without profiting by their experience.

The French writer, Belgrand, quoted by Professor Swain, touches the heart of the matter when he says: "The forests diminish very notably the volume of earthy matter transported by the streams, because they prevent the erosion of the earth, and it must be recognized that the impoverishment of the earth is much more to be deplored than the disasters caused by floods."

In the report of the chief of engineers, U. S. Army, for 1891 (p. 1107), Major Charles W. Raymond says: "The destruction of forests from the mountain crests and slopes of a watershed is undoubtedly the principal cause of the increase of the average magnitude of floods. The evidence collected during the last twenty-five years establishing this conclusion is well nigh overwhelming, and it is verified by repeated observations, not only in the mountains of Europe, but also in our own land"; and he refers to Colonel Torrelli, who "affirms as the result of careful observations that four fifths of the precipitation in forests is absorbed by the soil or detained by the surface of the ground to be gradually given up in springs and gentle rills, and only one fifth of the precipitation is delivered to the rivers rapidly enough to create floods. Upon the same slopes and surfaces denuded of their forests, the proportions are reversed. . . . That the destruction of the forests in mountainous watersheds is followed by disastrous floods where previously such floods were unknown is not a matter of theory, opinion or probability, but it is a well-established physical fact."

"In France, Italy, Germany and Austria the systematic planting of mountain slopes as a means of restoring lost fertility and preventing the inundations following the destruction of forests, is an established fact followed by results more satisfactory than the most sanguine anticipations."

The attempt to divert attention from the problem of the forest on the plea that it involves unsolved meteorological questions is an obscuring of the real question which concerns the soil. Governmental authority has been invoked ostensibly on account of increased difficulties and dangers to navigation of the rivers through neglect of their forest sources. Such perturbations of the streams do undoubtedly result from deforestation of the mountain slopes, but of far greater importance is the injury to the soil. The soil of

our native land should be even more sacred than its waters, and if necessary the constitution should be amended to enable the Congress to pass laws protecting the soil as well as the waters of our common heritage.

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WESTWOOD, MASS.,
November 25, 1911

SCIENTIFIC BOOKS

Characteristics of Existing Glaciers. By WILLIAM HERBERT HOBBS. New York, The Macmillan Company. 1911. Pp. ix + 301.

The author tells us that the book consists of three articles, more or less amplified, which he has contributed to scientific magazines. This explains the general character of the book, which is divided into three parts; the first deals principally with glacial erosion; the second with the ice masses of the Arctics and the third with those of the Antarctics. The subject is treated in regard to some of its larger aspects, such as geographical distribution, the general forms and the meteorological relations of the ice masses. The physical character of the ice which controls its movements, the relation of reservoir to dissipator, the formation of moraines and many other details are absent, as might be expected from what has been said above. On the other hand, far more space is given to the question of erosion and to meteorological conditions than is usual in books about glaciers.

In the first part, the subject of glacial erosion, both at the bottom of the valley and in the cirque wall, is considered. Here, for the first time, accounts of Matthes's theory of nivation and Willard D. Johnson's theory of bergschrund sapping are given to the general public. The author rejects Richter's idea of sapping just above the level of the névé, because it would produce a broad shelf, which has not been discovered; but he accepts Johnson's theory, though this method would also produce a shelf at a level only 150 or 200 feet lower. He has, however, presented convincing evidence to show that the cirque is enlarged by sapping and that the forms with which we are familiar in glaciated mountains are the result of the extension of cirques by glacier erosion.

There are many ways of classifying glaciers, according to the characteristics one desires to emphasize. The author classifies glaciers in accordance with the amount of alimentation, and brings out some interesting relationships of the different forms; but it seems that, in this matter, he has not put sufficient emphasis upon underlying topography.

The accounts of the Arctics and the Antarctics are particularly interesting; the author has evidently studied the reports of all the explorers and has brought them together in a very readable form and in such a way as to give an excellent general survey of those distant regions. He insists that there are very marked fundamental differences between the character of alimentation in the polar regions and in temperate zones. In the latter, the precipitation is due to moist winds being raised to cold altitudes by the mountains themselves and then precipitating their moisture in the form of snow. In the polar regions Professor Hobbs thinks that there are no surface air currents blowing across the great ice masses from the adjacent seas. It has been made out that over Greenland and over the Antarctics there are great regions of high barometer; and the reports of explorers show that they almost invariably encountered winds blowing off the surface of the ice, and when these winds attained a fair strength they carried with them many fine particles of snow which were swept along for considerable distances. These outward air currents Professor Hobbs ascribes to the cooling and consequently increased density of the air by contact with the cold surfaces, followed by the air sliding off the great ice cap in all directions. This, of course, requires that the return currents should flow in at a higher altitude, and sink down upon the ice from above. These currents, which bring but little moisture, are heated dynamically as they sink, melting and evaporating whatever ice spicules they may be carrying, and the vapor is again frozen as it approaches the ice surface. In this way he accounts for the falling snows under clear